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This study compared the unplanned pregnancy rate in soldiers against wives and daughters of soldiers. In addition, this investigation evaluated the relationships between a soldier's job, classified into specific job categories, as well as, some of the more common military occupational specialties and spontaneous abortion, small for gestational age, and preterm birth. This investigation found that pregnant soldiers who reside in the barracks demonstrated an unplanned pregnancy rate of 77.9 percent. The odds ratio for unplanned pregnancy in barracks residents was 4.32(3.24-5.78) and the odds ratio for pregnant barracks residents and never previously utilizing oral contraceptives was 2.55(1.87-3.48). These results may suggest access barriers to health care.

Soldiers in the logistics job category demonstrated an increased risk of spontaneous abortion, the odds ratio was 1.87(1.20-2.93), within the logistics job category soldiers in MOS 92A demonstrated an odds ratio of 2.55(1.48-4.37). No other occupations were found to be at risk for spontaneous abortion. Soldiers were not, and no soldier job categories were identified at increased risk of SGA or preterm birth. The most important predictors of SGA were Asian race 1.75(1.06-2.88), Black race 2.32(1.72-3.13), cigarette use 1/2 to 1 pack per day 2.17(1.45-3.26), and cigarette use more than 1 pack per day 2.71(1.17-6.29). The most important predictors of preterm birth were Black race 2.32(1.72-3.13) and cigarette use less than 1/2 per day 1.59(1.05-2.39).

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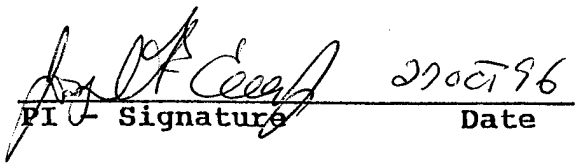

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Introduction

As of July 1995 there were 501,567 active duty soldiers in the United States Army, of which 67,982 were female. This population can be characterized as young (approximately 17-45 years of age) and reproductively active. The U.S. Army offers these women career opportunities that are varied and diverse, and include the majority of the U.S. Army military occupational specialties (MOS). No investigations have been conducted in soldiers regarding the risk of adverse pregnancy outcomes by MOS. The absolute risk of adverse reproductive outcomes in the offspring of female soldiers is unknown. This study has been designed to follow prospectively a cohort of female soldiers and a comparable group of non-soldiers to measure the absolute risk of adverse pregnancy outcomes and to identify job-related risk factors for adverse pregnancy outcomes in female soldiers.

The specific aims of this proposed study are to compare female soldiers serving in the U.S. Army with spouses and daughters of soldiers, and determine among female soldiers, serving in the U.S. Army: 1. the absolute and relative risk

of spontaneous abortion, small for gestational age (SGA), preterm birth by mother's job category, and 2: to elucidate the risk factors for unplanned pregnancies in soldiers.

REVIEW OF THE LITERATURE

Multiple epidemiologic investigations of occupation or employment and adverse reproductive outcomes have been undertaken. The results of which have, tended to be contradictory are summarized in Table 1. Savitz, et al. (1990) noted that studies of reproductive hazards in the workplace must address potential biases related to selection for employment (1). These investigators found that substantial differences in pregnancy-related risk factors exist in relation to employment, with working women generally having more favorable demographic and behavioral characteristics and less favorable reproductive histories. These authors describe an "unhealthy worker effect" whereby women who have healthy infants may stop work while their children are young, and women who fail to produce a surviving infant may be more likely to continue working.

Employment In General

Several studies have found no association between employment and various reproductive outcomes. Zuckerman, et al. (1986), reported from a population comprised of young, largely minority, economically disadvantaged American women (2), no adverse relations between working either outside the home, attending school during pregnancy, or standing work into the third trimester on the following outcomes: duration of gestation, birth weight, fetal length or head circumference. Hartikainen-Sorri (1989) evaluated employment outside the home and risk of preterm birth and reported no association between those variables while finding a strong association between both cigarette smoking and marital status and preterm birth (3). Najman, et al. (1989), conducted an investigation in Australia of employment of mothers and the outcomes of their pregnancies, and reported no significant differences between employed women and housewives in their physical health or pregnancy outcomes (4). Marbury, et al. (1990), found that working to term in the absence of contraindications does not impose an

added risk on the mother or the infant (5). Daniell, et al. (1990), examined birth records in Washington State from 1982-1983 and found no significant associations between maternal occupation and either birth weight or length of gestation (6).

Conversely, other investgators have found positive associations between employment and various reproductive outcomes. Lemasters and Pinney (1989) also noted that any type of maternal employment may be a risk factor for spontaneous abortion (7). Peoples-Sheps, et al. (1991), stated that non-black, married women, may face a risk of delivering low birth weight babies at or near term only if they work 40 or more hours each week (8). Shilling and Lalich conducted an analysis of the 1980 National Natality and National Fetal Mortality Surveys and found that compared with employed mothers of live-born infants, a greater proportion of employed mothers of low birth weight infants worked full-time but stopped working before the third trimester (9).

The ability to work usually implies an improved general state of health when compared to the non-employed population. Employment in general, usually increases income, which positively effects social economic status and increases access to health care. All of these factors are known to positively influence pregnancy and fetal outcomes.

The weight of scientific evidence from these studies suggests that employment in general is not a risk factor for adverse fetal outcomes. The investigation conducted by Lemasters et al. (7) did not stratify by previous spontaneous abortions and the relative risk, 1.23 (1.02,1.49) found between spontaneous abortion and any type of maternal employment was small. Employed women in that study may have been at higher risk for spontaneous abortion due to a selection bias. Those women who had previously miscarried may have remained in the work force, become pregnant again and were at increased risk to spontaneously abort again due to their previous reproductive history and not the fact of being employed.

Maternal Occupational Activity Level

Various investigators have found no association between maternal occupational activity level and spontaneous abortion, preterm birth, or fetal growth retardation. A study by Meyer and Daling (1985) found no association between the activity level of a mother's usual occupation and low infant birth weight (10). In addition, Rabkin, et al. (1990), found no association between maternal physical activity and birth weight (11). A study conducted by Klebanoff, et al. (1990), examined the relation of physically demanding, highly stressful work and pregnancy outcomes and reported that this type of work had little effect on a healthy population of high social status (12).

On the other hand, other investigators have found statistically significant associations between maternal occupational activity level and spontaneous abortion, preterm birth, or fetal growth retardation Homer, et al. (1990), found that work-related physical exertion increases a woman's risk of delivering a preterm, low birth weight infant (13). In a random sample of 2,387 employed French

women, cumulative physically tiring working conditions were related to rates of higher preterm delivery and low birth weight (14). Goulet and Theriault conducted a literature review of ergonomic factors associated with spontaneous abortion and found no association between shift work, piece work, or posture and spontaneous abortion yet, a positive association with heavy lifting or physical effort (15).

Saurel, et al. evaluated the pregnancies and birth outcomes of 621 women who worked in public hospitals from 1979-1981 and noted increased rates of preterm deliveries and low birth weight infants with arduous working conditions such as stand-up work, carrying heavy loads and heavy cleaning tasks (16). Mamelle, et al. studied 3,437 women in France from 1977-1978 and noted an increased rate of prematurity associated with high fatigue occupations (17). Mamelle and Munoz performed a case-control study in 1986 on 200 women whose infants were delivered preterm compared with 400 control women whose infants were delivered at term. These investigators noted that high occupational fatigue scores in women was associated with preterm birth (18).

Strong physical effort can alter hormonal balance, decrease uterine blood flow, increase intraabdominal pressure, and adversely effect nutritional status (19). Vigorous work, of long duration, seems to increase the risk of preterm delivery (13,14,16-18). The effect of maternal activity on spontaneous abortion and fetal growth is less clear. The results of the various studies are contradictory, which, is due to the fact that there is a lack of well validated and standardized methods to assess activity level and work load and thereby classify exposure. Different studies are difficult to compare, because of dissimilar categorization and classification of exposure.

STANDING

Standing position on the job was evaluated by both Teitelman, et al. (20), and Launer, et al. (21), in which, standing position was associated with low birth weight and preterm birth.

Occupations

The results of investigations comparing various occupations and adverse reproductive birth outcomes can be contradictory with some authors reporting no association between specific occupational groups and spontaneous abortion, preterm birth, or fetal growth retardation. McDonald, et al. (1988), in a study involving 47,913 pregnancies, which evaluated congenital defects and occupation, reported some evidence of excess risk to offspring of mothers employed in the agriculture, horticulture, telephone, and postal clerk occupations (22). This study evaluated 60 occupations and found no excess risk in the majority of the remaining occupations. These authors also noted no excess of spontaneous abortion, still birth, low birth weight, or congenital defects among offspring of women who work with video display terminals (VDT) (23). Nurminen and Kurppa (1988) conducted a case-control study to evaluate the effect of VDT exposure on duration of pregnancy and found no effect on length of gestation (24).

The following investigators reported positive associations between specific occupations and spontaneous abortion, preterm birth, or fetal growth retardation. McDonald, et al. (25,26), reported that women in managerial, health, and clerical sectors had little evidence of excess of the following outcomes: spontaneous abortion, stillbirth, congenital defects, or low birth weight. Statistically significant excesses of spontaneous abortion were observed in nursing aides and women in sales occupations and food and beverage service; of stillbirth in agriculture and horticulture, leather-work, and certain sales occupations; of congenital defects in women in child care, certain service occupations, and manufacture of metal and electrical goods; and of low birth weight in chambermaids, cleaners, and janitors, and in those engaged in the manufacture of food and drink, metal and electrical goods, and clothing.

Investigations Conducted on Military Women

The following investigators have demonstrated associations between service in the military and various

adverse fetal outcomes. Fox, et al. (28) conducted a study from 1974-1976 involving active duty Air Force personnel. This study's conclusions led the investigators to surmise that pregnancy during active duty represented a high risk pregnancy. Limitations in this investigation are primarily due to a small sample size (n=195 pregnancies), and a dramatically changed role and proportion of women in both the U.S. Army and U.S. Air Force in 1991 versus 1976. Birdsong (29) reported in 1987, an excess rate of ectopic pregnancies in U.S. enlisted soldiers and airmen assigned in West Germany, the crude rates were 1/27 and 1/32 respectively.

Other studies have focused on the health status and reproductive outcomes of Vietnam Veterans (30-33) and found, in general, no association between service in Vietnam and increased adverse fetal outcomes. Baker reported in 1989, from an investigation on health experiences of U.S. military nurses who served in Vietnam (34), an increased number of health problems of female nurses and their children. The health problems the nurses experienced were related to Post

Traumatic Stress Syndrome. The investigators did not specify the health problems of the nurses' children.

More recently, Ramirez, et al. (35), reported the results of retrospective study of occupational activity and preterm birth conducted in U.S. Army primigravidas. This investigation noted an increased risk of preterm delivery related to age, pay grade, and physical activity, with an odds ratio (OR) of 1.69 (1.08,2.64) for heavy, physically demanding tasks and an OR of 1.75 (1.12,2.75) for very heavy, physically demanding tasks. However, data were unavailable for confounders such as cigarette smoking, alcohol consumption, and pregnancy complications.

Magann and Thomas compared the pregnancy outcomes of 331 pregnant marines at Camp Lejune, North Carolina, with 1,218 wives of active duty personnel, matching for age and gravidity (36). These investigators reported differences in the rates of cesarean section in active duty marines versus spouses, 22.96% versus 14.94% ($p<.001$), pregnancy induced hypertension (PIH) 6.65% versus 3.2% ($p<.01$), and intrauterine growth retardation (IUGR) 2.42% versus 0.82%

($p<.05$). These investigators concluded that active duty pregnant women continue to represent a high risk population. However, there were some serious methodological issues with this investigation. One of the most serious was the investigators' inability to account for the impact of race. The racial distribution of the study populations was never obtained (37). Therefore, these results must be interpreted with caution.

Adams, et al. conducted a retrospective cohort study involving 842 black and 1,026 white enlisted women who delivered a singleton infant of more than 20 weeks gestation from July 1987 through September, 1990 (38). These authors found that black enlisted women had an adjusted cumulative probability of preterm delivery (13.5%) that was higher than that for white enlisted women (10.5%) (hazard ratio 1.31, 95%CI 1.002-1.70). This is in keeping with non-military populations. The black-to-white hazard ratios were greatest for all deliveries before 33 weeks gestation and for medically indicated preterm deliveries. Furthermore, these investigators noted significant differences in marital

status, gravidity, parity, smoking at entry into prenatal care, and birth weight between black and white enlisted women. More black enlisted women were single, they tended to have had more total pregnancies, more children, and more LBW infants than their white counterparts. Conversely, white enlisted women were more likely to be smokers at entry to their prenatal care.

These investigations suggest that soldiers are at elevated risk for spontaneous abortion, preterm birth and fetal growth retardation. However, these findings are limited in their utility by methodological issues such as the inability to account for the impact of race and previous reproductive history.

In order to graduate from basic combat training, soldiers must be physically fit enough to pass a physical fitness test. To enter into the Army women must have completed high school. This population is a young, healthy, physically fit group of individuals with essentially unlimited access to health care. These particular factors should improve pregnancy outcomes. The previous studies may

reflect the true state of nature or they could have been biased and confounded by differential racial distribution among the soldiers and comparison groups and the unhealthy worker reproductive effect mentioned in the introduction.

Table 1 Summary Table of Literature Review Comparing Employment Characteristics and Spontaneous Abortion, Preterm Birth and SGA.

Characteristic	Spontaneous Abortion	Preterm Birth	SGA
Employment in General	+ (7)	+ (8)	+ (9)
	− (4,5)	− (2-6)	− (2,4-6)
Maternal Activity Level	+ (15)	+ (13,14,16-18,20)	+ (13,14,16-18,20)
	−	− (10-12)	− (22)
Standing	+	+ (20,21)	+ (20,21)
U.S. Military	+ (28)	+ (35,36)	+ (35,36)

+ = positive association
- = no association

Methods

Entry	Followed	Outcomes obtained
Subject initiates prenatal care	⟶	Pregnancy completed

The proposed study of preterm birth and LBW occurring in the offspring of female soldiers will be conducted utilizing data derived from the "Army Pregnancy Study, Relationships Between a Female Soldier's MOS and Birth

Outcomes." This study was an ongoing prospective cohort study being conducted at five U.S. Army installations, Ft. Carson, Colorado, Ft. Hood, Texas, Ft. Lewis, Washington, Ft. Bragg, North Carolina, Ft. Campbell, Kentucky, and Ft. Riley, Kansas. The study originated at Ft. Carson in December, 1992 and was scheduled to be completed in August, 1996.

Subjects were enrolled at the obstetric registration classes that occur at each post and then followed until the end of the index pregnancy. These classes were used to initiate prenatal care in the military medical system and were conducted by obstetric and gynecologic clinic staff. Demographic data for the study were obtained using a proctored self-administered questionnaire administered under supervision during the registration classes. Outcome data were obtained by a study questionnaire placed in the OB record, which was completed by staff in both labor and delivery and in the newborn nursery. The study population consists of all pregnant female U.S. Army soldiers and pregnant wives and daughters of soldiers, who were U.S. Army

identification card holders, and who present for prenatal care at one of the above named locations.

Preterm birth was defined as birth greater than 20 and less than 37 weeks gestational age. Gestational age was determined by Ballard scoring, ultrasound, or last menstrual period (LMP). LMP was only used for live born infants when neither of the other two measures is available. This primarily occurred with deliveries occurring prior to 25 weeks gestation, in the event that an ultrasound had not been performed. Spontaneous abortion was defined as pregnancy loss less than or equal to 20 weeks gestational age, as determined by LMP or ultrasound.

Prenatal care is equally available to all beneficiaries, regardless of soldier status. Both soldiers and non-soldiers are encouraged to utilize early prenatal care. This care is available by appointment and at no monetary cost to the recipient. Pregnant soldiers have a vested interest in presenting early for prenatal care due to the fact that their duties will be limited for the duration of their pregnancies. Pregnant soldiers are specifically

prohibited from undergoing physical fitness testing, body fat assessment and chemical weapons training, which involves exposure to tear gas. These activities are regarded as, at best, unpleasant and these duty limitations encourage soldiers to seek early prenatal care. Less than half of the pregnant non-soldiers were employed and less than half of these women work full time. Less than half of the pregnant women, who were employed full time, had been working at their present job for at least a year. These jobs tend to be secretarial, food service, child care, and retail sales/cashier positions. The majority of these jobs may not offer health care benefits and if they do offer benefits, it is usually at some cost to the employee. Therefore, the military dependents would tend to decline the health care benefits, if offered, since the obstetric health care benefits provided by the U.S. Army are comprehensive and at no cost when the service is provided at the U.S. Army hospital. For the above reasons it is estimated that less than one percent of the pregnant soldiers and less than five

percent of the pregnant non-soldiers seek and receive obstetric care at other than U.S. Army medical facilities.

There is no mechanism within the U.S. Army medical system to ascertain the current rates of spontaneous or elective abortions prior to registration for OB care. It is well known by the beneficiary population that elective abortions are not performed at any of the U.S. Army medical facilities inside the United States. Therefore, due to confidentiality concerns, many women who intend to undergo elective abortion seek pregnancy testing outside of the U.S. Army medical system. Any estimate of the frequency of this occurrence would be speculative.

In contrast, an appointment can be scheduled for OB registration within two weeks of the request. Therefore, it is estimated that less than five percent of spontaneous abortions occurring in known pregnancies happen prior to OB registration. Any estimate of the frequency of spontaneous abortion in women prior to a positive pregnancy test would be conjectural.

The following inclusion criteria were used: all pregnant female U.S. Army soldiers and pregnant wives and daughters of soldiers, aged greater than or equal to 18 years, who are United States military identification card holders and who present for prenatal care at one of the above named locations. Pregnant female soldiers will comprise the study group and pregnant wives and daughters of soldiers will constitute the comparison group. In the event that both husband and wife are soldiers on active duty, the pregnant soldier will be counted in the study group.

Pregnancy will be determined by a positive urine human choriogonadotropin (HCG) test prior to or at the time of registration for obstetrical care.

The following exclusion criteria were used: female soldiers in the U.S. Army National Guard, Active U.S. Army Reserve, and daughters of eligible beneficiaries less than 18 years of age. Soldiers in the national guard and reserves were excluded due to the fact that these individuals only work in their MOS on a part time basis for one weekend a month and an additional two weeks a year.

They undergo a fraction of the Army occupational exposures that their full time active duty counterparts experience. The inclusion of the national guard and reserve forces in with the active duty population would increase the variability in the data set and decrease precision.

Body

Data Collection And Management

A three-day training seminar was conducted in April, 1994 for the research assistants. This seminar included a four hour class concerning the proctored, self-administered questionnaire. Independent variables, including job categories (MOS), were ascertained from a proctored, self-administered questionnaire given to the mother at the time of the initial OB registration.

Dependent variables were ascertained by way of a physical examination of the newborn conducted by both the labor and delivery and newborn nursery staff within one hour after delivery. Spontaneous abortions were ascertained through reporting from the staff of the OB clinics and wards, reviewing the registers of the respective emergency

rooms, and reviewing referrals to mental health clinics for grief counseling secondary to pregnancy loss.

Data entry and validation are accomplished by having each research assistant enter the data into one file and a Red Cross volunteer enter the same information into another file at each installation. Then both files are compared using the Validate program in Epi Info version 5.02 (39). This program cross-checks the data entered into both files and then lists discrepancies between the files. Mismatches are then corrected by reviewing the study records and editing the erroneous entry. In addition, a missing data program is used to identify variables with blank entries. The research assistants ran this program as often as necessary at each site and attempted to obtain the missing data. Data disks were forwarded monthly by mail to the PI. Upon receipt of updated disks the PI performed range checks, residual plots and missing data checks for each site. Each updated disk is discussed with each site research assistant.

Study Variables:

The major independent variables of interest are:

1. Mother's MOS (MMOS) for soldier occupations with at least 45 individuals in that specific job code.

2. Mother's occupational category (MJCAT)

Outcome Variables

The dependent variables in the proposed study are:

1. Spontaneous abortion (SA)(fetal loss prior to 20 wks GA)

2. Preterm delivery (<37 wks GA)

3. SGA (< 10th percentile for gestation in completed weeks, based upon the U.S. National Reference for Fetal Growth).

Confounder and Covariate Variables

Potential confounding variables in these analyses include:

1. Mother: age in years (MAGE)

2. Mother's race (MRACE)

3. Marital status (MARIT)

4. Rank

5. Educational level by highest degree completed (ED)

6. Average annual combined family income (INC)

7. Cigarette smoking (CIG)
   0 = nonsmoker
   1 = less than 1/2 pack per day
   2 = 1/2 to 1 pack per day
   3 = more than 1 pack but less than 2 packs per day
   4 = more than 2 packs per day

8. Daily caffeine intake (CAF)

The sum of number of 8 oz cups of caffienated coffee or tea, plus the number of 12 oz glasses of iced tea, plus the number of caffienated 12 oz soft drinks consumed per day.

9. Parity (PAR)

10. Gravidity (GRA)

11. Number of previous spontaneous abortions (PSA)

12. Number of previous preterm deliveries (PPD)

13. Number of previous low birth weight infants (PLBW)

Illicit Drug and Alcohol Use

Questions regarding illicit drug use and alcohol used were specifically not asked as a part of this investigation. The Army imposes severe penalties on soldiers found to be using illicit drugs. These penalties include non-judicial punishment, court martial, and/or discharge from the

service. In addition, alcohol abuse, if known by the command, will not be tolerated. Soldiers can easily be forced to attend alcohol rehabilitation programs which can last from six months to three years in duration. Unsuccessful completion of these programs will result in discharge from the Army.

In addition, soldier medical records are not afforded the same confidentiality protection as their civilian counterparts. While, commanders may not request an individual soldier's medical records for the commander to review, a commander may ask specific questions of the unit's medical personnel regarding medical conditions including drug and alcohol use of specific soldiers. Under the "need to know" doctrine this information is provided to commanders. Lastly, medical personnel are required to report all service members with suspected substance abuse problems to the individual soldier's commander. The only exception to this policy is when an individual voluntarily seeks treatment for substance abuse.

Bray et al. conducted a randomly selected, anonymous survey of health related behaviors among military personnel in 1995, for the U.S. Department of Defense (DOD) (40) and reported that 85.2 percent of women who had been pregnant in the past five years had abstained from alcohol during their last pregnancy. This investigation surveyed 3,638 Army soldiers and reported that four percent of soldiers had used some form of illicit drug in the last 30 days and 9.2 percent had used some form of illicit drug in the last year. The most commonly used drug was marijuana with a prevalence of 7.3 percent for the last year, and the prevalence of any illicit drug use except marijuana was 4.7 percent in the last year.

These authors also compared the prevalence of illicit drug use and heavy drinking between soldiers and civilians. The civilian data source was from the National Household Survey on Drug Abuse commissioned in 1994 by the Department of Health and Human Services (40). There were no statistically significant differences in heavy drinking prevalence for women age 18-25, 26-55, as well as all ages

between the soldier and civilian groups. Furthermore, the prevalence of illicit drug use in female soldiers was significantly less than their female civilian counterparts, 4.1 % vs. 9.0 %, in the 18-25 year olds, 1.5 % vs. 4.1 % in the 26-55 year olds, and 2.8 % vs. 6.4 % for women of all ages.

While this current investigation would not have reported substance abuse to commanders, convincing the pregnant soldiers of this would have been difficult. It was surmised by the PI that soldiers who were substance abusers, with the exception of cigarette use, would have a perceived vested interest in not reporting or in under-reporting their substance use. The DOD survey suggested a low prevalence of illicit drug use, other than marijuana, and the inclusion of substance abuse questions was felt to generate unreliable data which could adversely impact the validity of this study. Therefore, questions relating to substance abuse other than cigarette use were excluded from this investigation.

A complete list of all variables ascertained appears in Appendix 1.

Occupational Classification

The MOS is designated by a three-character code consisting of two numbers and one letter. For example 63B is the MOS for a light wheel mechanic. Soldier occupations will also be classified, through the use of their MOS, into one of the following categories: administrative, electronics repair, maintenance of motor vehicle or aircraft, medical, and supply/services (Appendix 6): The categories were created to reflect the potential exposures to specific types of agents within the occupations and considering the numbers of soldiers assigned within a particular MOS (i.e., the sample size within the categories).

The distribution of rank in the Army is approximately 90 percent enlisted, eight percent officer and less than two percent warrant officer. There are 639 separate occupations, 108 officer, 150 warrant officer and 381 enlisted, in which female soldiers can be trained. This investigation is expected to capture approximately 200 of

these occupations. These 200 reflect the most common MOS codes for enlisted women.

In general, warrant officer ascension involves gaining ten to fifteen years of job experience as an enlisted soldier and then applying for warrant status. Therefore, very few female warrant officers would be expected to be pregnant at this point in their careers and subsequently, very few are expected to be eligible to participate in this study. Female commissioned officers are expected to comprise approximately five to eight percent of the total soldier pregnancies, which is consistent with the percent of female officers in the Army.

Some occupations are highly specialized and not directly related to supporting and maintaining the day-to-day operations of a combat force in the field. Consequently, there is an overall need for relatively few soldiers in that MOS, which leads to a small absolute frequency of pregnant soldiers in that MOS compared to the rest of the occupations. An example of this would be MOS, 01H Biological Sciences Specialist. Finally, there are a

number of occupations in which soldiers have been trained that are being phased out, such as, the Lance and Pershing air defense artillery fields. The MOS for this occupation is still in the inventory but is no longer being utilized. Soldiers in these career areas have already been retrained in other Army occupations.

A specific MOS will be evaluated individually as an independent variable if there are at least 45 soldiers with that particular MOS in this study, other soldier occupations will be classified into job categories for statistical analysis.

Results

Statistical Analysis

The data regarding unplanned pregnancies oral contraceptive use, and residence was obtained cross-sectionally. These variables were ascertained at the same time during the OB registration class. The birth outcome data was collected prospectively, after the study group had

been followed over time. Therefore, all 4,285 initial respondents, will be analyzed for the cross sectional data.

For the prospective analysis of the birth data, 18 of the subjects were eliminated due to their eligibility status being classified as other. These were women who's spouses had been separated from active duty but were still eligible for Army health care, this only occurred in 1993. Furthermore, an additional 25 were removed due to multiple fetuses in this current pregnancy, as well as, 597 incomplete records. The over all completion rate for this investigation was 85.9 percent. The final sample size was 3,541 respondents with 1,014 soldiers and 2,631 non-soldiers.

Minimum Detectable Relative Risk

Minimum detectable relative risk estimates, at 95 percent confidence and 80 percent power, were estimated through formula 6.11 by Schlesselman (41). The minimum detectable relative risk for spontaneous abortion and SGA ranged from 1.62 to 2.14, and was based upon an estimated

nine percent occurrence of these outcomes in the non-soldier population (Table 2). Similarly, the range of minimum detectable relative risk for preterm birth ranged from 1.60 to 2.11 and was based upon an estimated 7.2 percent occurrence of preterm birth in the non-soldier population (Table 3).

Table 2 Minimum Detectable Relative Risk for Spontaneous Abortion and SGA by Job Category.

Job Category	Frequency	Minimum Detectable Relative Risk+
Administration	183	1.66
Electronics repair	75	2.14
Logistics	172	1.68
Maintenance	184	1.66
Medical	194	1.64
Supply & services	206	1.62
Non-soldiers	2631	reference

+ based upon an 8.7 incidence of spontaneous abortion and an 8.8 percent incidence of SGA in the non-soldier population rounded to 9 percent.

Table 3 Minimum Detectable Relative Risk for Preterm Birth by Job Category.

Job Category	Frequency	Minimum Detectable Relative Risk+
Administration	183	1.65
Electronics repair	75	2.11
Logistics	172	1.67
Maintenance	184	1.65
Medical	194	1.63
Supply & services	206	1.60
Non-soldiers	2631	reference

+ based upon a 7.2 incidence of preterm birth in the non-soldier population.

Power

Power estimates were performed at 95 percent confidence employing both the Epitable and Statcalc modules of Epi Info version 6.04 (42). There is at least 80 percent power to detect a relative risk of 2.5. for all outcomes (Tables 4,5)

Table 4 Power for Spontaneous Abortion and SGA by Job Category[++].

Job Category	Frequency	Power % [+]	Power % *
Administration	183	87	99
Electronics Repair	75	57	82
Logistics	172	85	98
Maintenance	184	87	99
Medical	194	88	99
Supply & Services	206	90	99
Non-soldiers	2631	reference	reference

+ power calculations based upon estimated relative risk of 2.0
* power calculations based upon estimated relative risk of 2.5
++ based upon an 8.7 incidence of spontaneous abortion and an 8.8 percent incidence of SGA in the non-soldier population rounded to 9 percent.

Table 5 Power for Preterm Birth by Job Category[++]

Job Category	Frequency	Power % [+]	Power % *
Administration	183	81	97
Electronics repair	75	50	80**
Logistics	172	80**	96
Maintenance	184	81	97
Medical	194	83	97
Supply & services	206	85	98
Non-soldiers	2631	reference	reference

++ based upon a 7.2 incidence of preterm birth in the non-soldier population.
+ power calculations based upon estimated relative risk of 2.0
* power calculations based upon estimated relative risk of 2.5
** estimated through the use of STATCALC in Epi Info Version 6.04

Summary Statistics

Variables were summarized through the use of SPSS version 6.3 (43). This investigation originated at Fort Carson, with enrollment of subjects starting in December of 1992. Funding was obtained in 1994, and recruitment began at the other installations in May of 1994 (Table 6). A total of 1,180 soldier's were enrolled which comprised 27.8 percent of the study population (Table 6). The non-soldier group consisted of 59 daughters of active duty soldiers, 94 daughters of retired soldiers, 2,873 spouses of active duty soldiers, and 35 spouses of retired soldiers(Table 6).

Table 6 Frequencies Of Respondents By Installation And Eligibility Status.

Variable	Frequency	Percent	95%CI*
Post			
Fort Bragg (May 94 - Aug 96)	600	14.1	13.1-15.2
Fort Campbell (May 94 - Jun 96)	342	8.1	7.3-8.9
Fort Carson (Dec 92 - Aug 96)	2412	56.9	55.4-58.4
Fort Lewis (May 94 - Aug 96)	658	15.5	14.4-16.6
Fort Riley (May 94 - June 96)	229	5.4	4.7-6.1
Eligibility Status			
Active Duty	1180	27.8	26.5-29.2
Daughter of Active Duty	59	1.4	1.1-1.8
Daughter of Retiree	95	2.2	1.8-2.7
Spouse of Active Duty	2873	67.7	66.3-69.1
Spouse of Retiree	35	0.8	0.6-1.2

* Exact Binomial (44)
N = 4,242

The soldier and non-soldiers groups varied regarding marital status, 60.3 percent of the soldiers were married and 94.3 percent of the non-soldiers were married (Table 7). Conversely, 27.2 percent of the soldier cohort was categorized as single verses 4.2 percent of the non-soldier group (Table 7).

The racial distributions also varied between the soldier and non-soldier cohorts. Among pregnant soldiers, Blacks represented 41.9 percent and Caucasians comprised 46.0 percent of all pregnancies, the black to white ratio was approximately 1:1 (Table 7). However, regarding the pregnant, non-soldier cohort, Blacks accounted for 13.4 percent and Caucasians contributed 70.9 percent of the pregnancies in this group, the black to white ratio was approximately 1:5.3 (Table 7). More importantly, the percentage of Blacks in the soldier group is over 3 time greater than the percentage of Blacks in the non-soldier group. Black race is a known risk factor for SGA so

comparisons regarding SGA must be adjusted or stratified for race.

Table 7 Frequencies Of Martial Status And Race For Soldier And Non-Soldier Cohorts.

	Soldiers			Non-Soldiers		
Variable	Frequency	Percent	95%CI*	Frequency	Percent	95%CI*
Marital Status						
Single	323	27.4	24.9-30.0	128	4.2	3.5-5.0
Married	711	60.3	57.4-63.1	2886	94.3	93.4-95.1
Divorced/Separated	98	8.3	6.8-10.1	24	0.8	0.5-1.2
Cohabiting	47	4.0	3.0-5.3	23	0.8	0.5-1.1
Widowed	1	0.1	0.0-0.5	0	0	
Race						
Asian	30	2.5	1.8-3.7	166	5.4	4.7-6.3
Black	494	41.9	39.0-44.7	409	13.4	12.2-14.6
Caucasian	543	46.0	43.1-48.9	2170	70.9	69.2-72.5
Hispanic	113	9.6	8.0-11.4	316	10.3	9.3-11.5

* Exact Binomial
N = 4,242

There were 2,827 subjects who had a total of 5,575 previous pregnancies, which occured prior to entry into this investigation (Table 8). In these respondents, previous pregnancies ranged from 1 to 13, previous spontaneous abortions from 0 to 9, previous low birth weight deliveries (birth weight less than either 5 lbs 9 oz or 2,500 gms) from 0 to 6, and previous preterm birth (birth more than three weeks early or before 37 weeks gestation) from 0 to 6.

Table 8 Number Of Previous Pregnancies, Previous Spontaneous Abortions, Previous Low Birth Weight, And Previous Preterm Pregnancies.

Variable	Minimum	25th%*	Mean	Median	75th%*	Maximum	Sum
Previous Pregnancies	1	1	1.97	2	2	13	5575
Previous Spontaneous Abortions	0	0	0.48	0	1	9	1354
Previous Low Birth Weight	0	0	0.05	0	0	6	132
Previous Preterm Birth	0	0	0.09	0	0	6	261

* percentile
N = 2,827

The mean family income for all respondents combined was 24.33 years with a standard deviation of 4.53 years. The mean income, birth weight, and birth length was 2,464 dollars per month, 3.322 grams, and 50.4 centimeters (Table 9).

Table 9 Mother's Age, Family Income, Birth Weight, And Birth Length.

Variable	Mean	SD	Minimum	Maximum	N
Age (yrs)	24.33	4.52	14	43	3645
Income ($/month)	2464	1075	0	9431	3629
Birth Weight (gm)	3322	609	175	9219	3267
Birth Length (cm)	50.4	3.5	18.5	63.3	3243

Univariate analysis revealed no statistically significant differences in gestational age, caffeine consumption, or cigarette use comparing soldiers to non-soldiers (Table 10). The mean age of the soldiers was 23.6

years and the non-soldiers was 24.4 years with a statistically significant difference of 0.75 years ($p<0.0001$)(Table 10, Figure 1). The racial distribution significantly varied between soldiers and the comparison group. Black race accounted for 41.9 percent of the subjects in the soldiers group and 13.4 percent of the subjects in the non-soldier cohort. The black to caucasian ratio among soldiers is almost 1:1 (Tables 7,10, Figure 2). Education level varied by category, with more non-soldiers classified as having no degree, and more non-soldiers with completed education beyond high school (Table 10, Figure 3). A higher percentage of soldiers reported that this current pregnancy was unplanned than the non-soldiers group, 53.7 vs. 42.1 ($p<0.0001$) (Table 10). The mean birth weight of infants born to female soldiers was 60 grams less than the comparison group, 3279 grams vs. 3339 grams, ($p=0.0122$), and soldiers averaged 155 dollars more family income per month, $2,544 vs. $2,389 (Table 10).

Figure 1 Mother's Age Soldier verses Non-Soldier

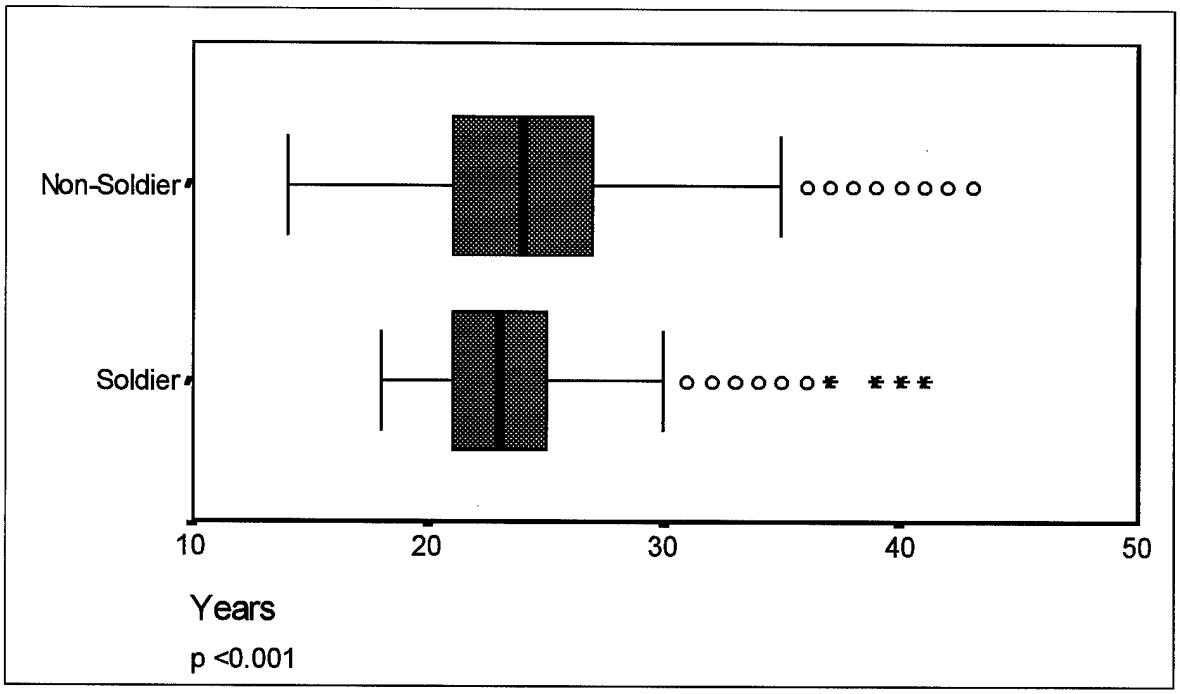

Figure 2 Racial Distribution Soldiers verses Non-Soldiers

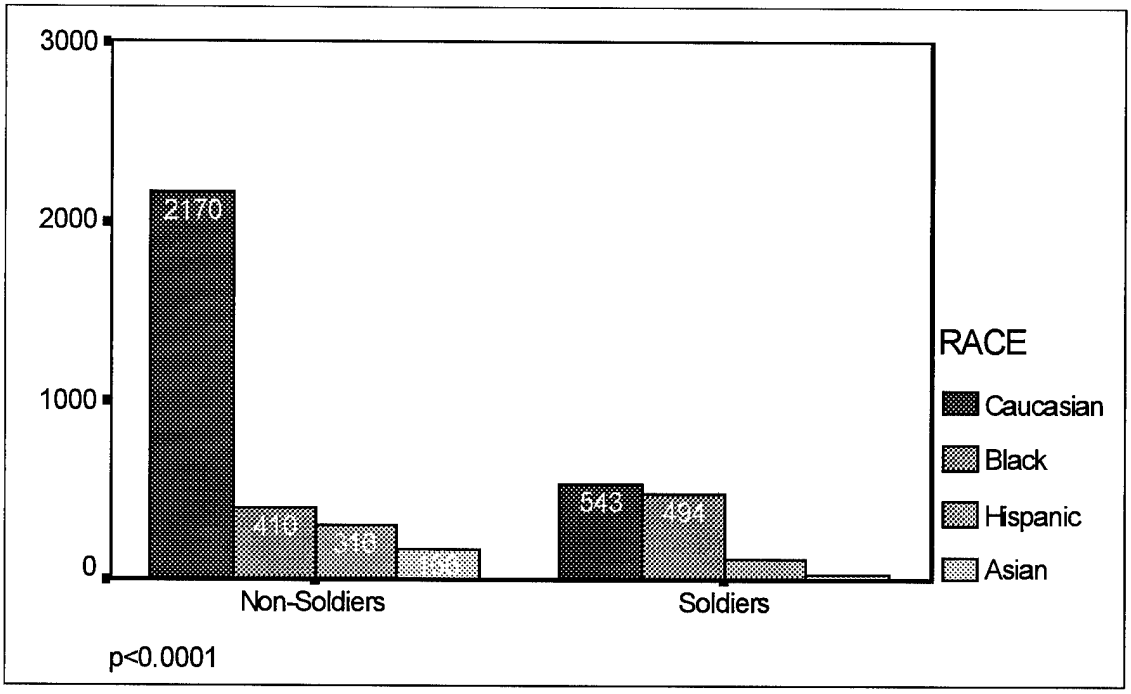

Figure 3 Education Level Soldiers verses Non-Soldiers

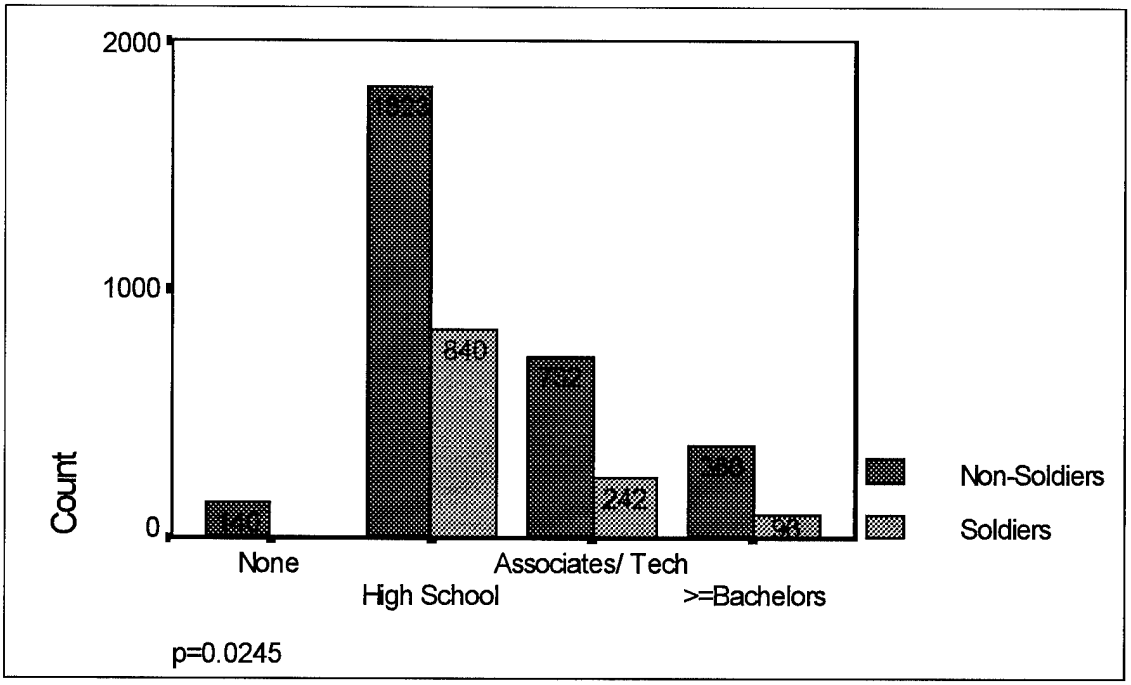

Table 10 Univariate Comparisons Of Soldiers verses Non-Soldiers.

Variable	p-value
Education Level	0.0245+
Race	<0.0001*
Unplanned Pregnancy	<0.0001*
Income	0.0001+
Cigarettes	0.1769+
Mother's Age	<0.0001#
Caffeine	0.1723#
Birth Weight	0.0122#
Gestational Age	0.5701#

+ Wilcoxon Rank Sum Test
* Pearsons Chi-Square Test
# One Way Analysis Of Variance

No univariate associations were noted between spontaneous abortion and the following variables soldier vs. non-soldier, race, marital status, education level, cigarette use, and caffeine consumption (Table 11). Women who underwent spontaneous abortion in this current pregnancy were on average 0.90 years older than those women who did not spontaneously abort, 25.15 vs. 24.25.

Table 11 Univariate Analysis Of Spontaneous Abortion.

Variable	p-value
Soldier	0.6545*
Race	0.3143*
Marital Status	0.1994*
Education Level	0.9840+
Cigarettes	0.8611+
Caffeine	0.5466#
Mother's Age	0.0006#

* Pearsons Chi-Square Test
+ Wilcoxon Rank Sum Test
# One Way Analysis Of Variance

No univariate associations were noted between SGA and the following variables soldier vs. non-soldier, and education level (Table 12). SGA was noted in 7.6 percent of births to Caucasians, 11.7 percent of birth to Asians, 14.7 percent of births to Blacks, and 9.1 percent of births to Hispanic women $p<0.0001$(Table 12). Pregnancies in single women resulted in SGA in 13.8 percent of births compared with 8.8 percent in married women ($p=0.0183$). SGA was also significantly related to income, cigarette use, and mother's age.

Table 12 Univariate Analysis Of SGA.

Variable	p-value
Soldier	0.0695*
Race	<0.0001*
Marital Status	0.0183*
Education Level	0.2329+
Cigarettes	0.0020+
Income	0.0473#
Mother's Age	0.0457#

* Pearsons Chi-Square Test
+ Wilcoxon Rank Sum Test
# One Way Analysis Of Variance

Preterm birth was not related to soldier status, cigarette use, family income, or mother's age (Table 13). Black race demonstrated an increased percentage of preterm births accounting for ten percent of deliveries to black women (p=0.0296). Single women underwent the highest percentage of preterm birth 11.7 percent vs. 7.0 percent for married women (p=0.0148) (Table 13). Preterm birth varied by educational level, mothers who did not complete high school or a GED, demonstrated a 9.1 percent preterm birth rate while mother's who achieved a technical or associates degree demonstrated the smallest rate of preterm birth of 5.2 percent (p=0.0256).

Table 13 Univariate Analysis Of Preterm Birth

Variable	p-value
Soldier	0.4823*
Race	0.0296*
Marital Status	0.0148*
Education Level	0.0256+
Cigarettes	0.5364+
Income	0.8583#
Mother's Age	0.8569#

* Pearsons Chi-Square Test
+ Wilcoxon Rank Sum Test
# One Way Analysis Of Variance

Unplanned Pregnancies In Soldiers

Non-soldiers reported an unplanned pregnancy rate of 42.8 percent, while the unplanned pregnancy rate for all soldiers was 54.6 percent, barracks residents demonstrated an unplanned pregnancy rate of 77.9 percent (Table 14). Among all soldiers 24.5 percent of the pregnancies occurred in soldiers who had been on active duty one or less years and among pregnant soldiers residing in the barracks 42.6 percent occurred in individuals with one or less years of active duty (Table 15). The odds ratio for barracks residents verses unplanned pregnancy was 4.32(3.24-5.78) and the odds ratio for barracks residents and never having utilized oral contraceptives was 2.55(1.87-3.48) (Table 16).

Table 14 Unplanned Pregnancies And Never Utilizing Oral Contraceptive In Non-Soldiers, All Soldiers, And Barracks Residents.

Variable	Frequency	Percent	95%CI*
Unplanned Pregnancies			
Non-Soldiers	1326/3098	42.8	41.1-44.6
All Soldiers	646/1180	54.6	51.7-57.4
Barracks Residents	264/339	77.9	73.0-82.1
Never Utilized Oral Contraceptives			
Non-Soldiers	530/3101	17.1	15.8-18.5
All Soldiers	204/1180	17.2	15.1-19.5
Barracks Residents	94/339	27.7	23.1-32.9

* Exact Binomial

Table 15 Pregnancies Occurring In ALL Soldiers And Barracks Residents With One Or less Years Of Active Duty.

Variable	Frequency	Percent	95%CI*
All Soldiers	290/1180	24.6	22.1-27.1
Barracks Residents	145/339	42.6	37.4-48.1

* Exact Binomial

Table 16 Odds Ratios For Barracks Residents Verses Unplanned Pregnancies And Never Using Oral Contraceptives.

Variable	OR	95%CI*
Unplanned Pregnancy	**4.32**	**3.24-5.78**
Never Utilized OCPs	**2.55**	**1.87-3.48**

* Exact Mid P

Incidence By Job Category And MOS

The following incidence rates are crude unadjusted rates, the effect of age, race and other covariates will be analyzed in the multivariate modeling section.

The baseline incidence of spontaneous abortion in the non-soldier cohort was 8.7 percent (Table 17). The incidence of spontaneous abortion in the logistics job category was 14.8 percent, and the crude relative risk was 1.61(1.09-2.37). None of the other relative risk estimates for job category and spontaneous abortion were statistically significant or in excess of 1.5.

The MOS 92A, which is a logistics specialist, demonstrated an elevated incidence of miscarriage. The rate was 17.8 percent, which lead to a crude relative risk of 2.23(1.41-3.52) (Table 18). None of the other relative risk estimates for individual MOSes and spontaneous abortion were statistically significant or in excess of 1.5.

Table 17 Incidence per 100 and Relative Risk Compared to Non-Soldiers of Spontaneous Abortion by Job Category

Job	# SAB	Incidence	Crude RR	95%CI*
Administration	15/180	8.3	0.96	0.58-1.59
Electronics Repair	5/74	6.8	0.79	0.34-1.87
Logistics	25/169	14.8	**1.61**	**1.09-2.37**
Maintenance	13/183	7.1	0.83	0.48-1.42
Medical	16/192	8.3	0.96	0.59-1.57
Supply&Services	18/206	8.7	1.00	0.63-1.59
Non-Soldiers	228/2623	8.7		

* Taylor Series

Table 18 Incidence per 100 and Relative Risk Compared to Non-Soldiers of Spontaneous Abortion by MOS

MOS	# SAB	Incidence	Crude RR	95%CI*
88M	6/48	12.5	1.47	0.63-3.43
91B	9/81	11.1	1.29	0.65-2.55
92A	21/118	17.8	**2.23**	**1.41-3.52**
92Y	4/54	7.4	0.82	0.30-2.26
94B	6/49	12.2	1.44	0.62-3.35
Non-Soldiers	228/2623	8.7		

* Taylor Series

The baseline incidence of SGA in the non-soldier cohort was 8.8 percent (Table 19). The incidence of SGA in the maintenance job category was 15.9 percent, and the crude relative risk was 1.69(1.16-2.46). None of the other relative risk estimates for job category and SGA were statistically significant or in excess of 1.5.

The MOS 88M, which is a transportation specialist, demonstrated an elevated non-significant incidence of SGA. The rate was 14.3 percent, which lead to a crude relative risk of 1.62(0.69-3.81) (Table 20). None of the other relative risk estimates for individual MOSes and SGA were statistically significant or in excess of 1.5.

Table 19 Incidence per 100 and Relative Risk Compared to Non-Soldiers of SGA by Job Category

Job	# SAB	Incidence	Crude RR	95%CI*
Administration	15/160	9.4	1.06	0.64-1.74
Electronics Repair	8/69	11.6	1.28	0.66-2.50
Logistics	18/142	12.7	1.39	0.88-2.18
Maintenance	27/170	15.9	**1.69**	**1.16-2.46**
Medical	19/172	11.0	1.23	0.79-1.92
Supply&Services	11/186	5.9	0.69	0.38-1.24
Non-Soldiers	209/2368	8.8		

* Taylor Series

Table 20 Incidence per 100 and Relative Risk Compared to Non-Soldiers of SGA by MOS

MOS	# SGA	Incidence	Crude RR	95%CI*
88M	6/42	14.3	1.62	0.69-3.81
91B	9/71	12.7	1.41	0.71-2.81
92A	12/94	12.8	1.42	0.78-2.57
92Y	6/48	12.5	1.39	0.59-3.24
94B	2/42	4.8	0.49	0.12-2.00
Non-Soldiers	209/2368	8.8		

* Taylor Series

The baseline incidence of preterm birth in the non-soldier cohort was 7.2 percent (Table 21). The incidence of preterm birth in the maintenance job category was 11.9 percent, and the crude relative risk was 1.58(1.01-2.48). None of the other relative risk estimates for job category and preterm birth were statistically significant or in excess of 1.5.

The MOS 91B, which is a medical specialist, demonstrated an elevated non-significant incidence of

preterm birth. The rate was 11.3 percent, which leads to a crude relative risk of 1.59(0.77-3.28) (Table 22). None of the other relative risk estimates for individual MOSes and preterm birth were statistically significant or in excess of 1.5.

Table 21 Incidence per 100 and Relative Risk Compared to Non-Soldiers of Preterm by Job Category

Job	# Preterm	Incidence	Crude RR	95%CI*
Administration	19/160	11.9	**1.58**	**1.01-2.48**
Electronics Repair	3/68	4.4	0.63	0.21-1.92
Logistics	10/142	7.0	0.98	0.53-1.82
Maintenance	14/170	8.2	1.13	0.67-1.91
Medical	13/174	7.5	1.04	0.60-1.78
Supply&Services	12/184	6.5	0.91	0.52-1.61
Non-Soldiers	170/2363	7.2		

* Taylor Series

Table 22 Incidence per 100 and Relative Risk Compared to Non-Soldiers of Preterm by MOS

MOS	# Preterm	Incidence	Crude RR	95%CI*
88M	2/42	4.8	0.63	0.15-2.58
91B	8/71	11.3	1.59	0.77-3.28
92A	7/94	7.4	1.01	0.47-2.15
92Y	3/48	6.3	0.84	0.26-2.67
94B	3/39	7.12	0.96	0.30-3.10
Non-Soldiers	170/2363	7.2		

* Taylor Series

Multivariate Modeling

In order to control for confounding, statistical modeling was accomplished through the use of multiple

logistic regression (45). Soldiers were compared by job category against non-soldiers. Model reduction was accomplished primarily through what made sound biological sense.

After adjusting for mother's age, the odds ratio for the logistics job category and spontaneous abortion was 1.87(1.20-2.93) (Table 23). None of the following variables, when included in the statistical model, either substantially altered the regression coefficient or were statistically significant: race, income, cigarette use, caffeine consumption, or education level.

In the logistic regression of spontaneous abortion and specific MOSes, a significant association was noted MOS 92A, the odds ratio was 2.55(1.48-4.37), after adjustment for income, mother's age, and mother's rank (Table 24). None of the following variables, when included in this statistical model, either substantially altered the regression coefficient or were statistically significant: race, cigarette use, caffeine consumption, or education level.

Table 23 Logistic Regression of Spontaneous Abortion with Job Category, Adjusted For Mother's Age.

Variable	Coefficient	SE	Coef/SE	OR	95%CI*
Constant	-3.3890	0.3179	113.6776		
Job Category**					
Administration	-0.0593	0.2786	0.0453	0.94	0.54-1.63
Electronics Repair	-0.2732	0.4686	0.3398	0.76	0.30-1.91
Logistics	0.6262	0.2282	7.5284	**1.87**	**1.20-2.93**
Maintenance	-0.1650	0.2968	0.3088	0.85	0.47-1.52
Medical	0.0118	0.2635	0.0020	1.01	0.60-1.70
Supply&Services	0.0334	0.2568	0.0169	1.03	0.63-1.71
Mother's Age	0.0429	0.0122	12.3843	**1.04**	**1.02-1.06**

* Woolf's method
** Non-Soldiers as reference category

Table 24 Logistic Regression of Spontaneous Abortion with MOS 92A Adjusted For Income, Mother's Age, And Mother's Rank.

Variable	Coefficient	SE	Coef/SE	OR	95%CI*
Constant	-3.9699	0.9160	18.7812		
92A	0.9349	0.2715	11.8554	**2.55**	**1.48-4.37**
Income	-0.0002	0.0001	3.8377	1.00	0.99-1.00
Mother's Age	0.0850	0.0338	6.3234	**1.09**	**1.02-1.16**
Mother's Rank**					
E1-E3	0.2036	0.5396	0.1425	1.23	0.43-3.53
E4	-0.2702	0.4814	0.3151	0.76	0.30-1.96
E5	-0.1634	0.4710	0.1203	0.85	0.34-2.14

* Woolf's method
** E6 and above as reference category

After adjusting for mother's age, mother's race, and cigarette use, none of the odds ratios for any of the job categories and SGA were statistically significant or greater than 1.5 (Table 25). None of the following variables substantially altered the job category regression

coefficient or were statistically significant: income, caffeine consumption, or education level.

There was a significant relationship between mother's race and SGA. Infants who were SGA were more likely to be offspring of Asian and Black women regardless of job category or soldier status. The odds ratio for SGA and Asian race was 1.75(1.06-2.88) and the odds ratio for SGA and Black race was 2.32(1.72-3.13)(Table 25).

Cigarette use was significantly related to SGA, and a clear dose response relationship existed. The odds ratios for less than 1/2 pack per day was 1.25(0.83-1.88), for 1/2 to 1 pack was 2.17(1.45-3.26), and the odds ratio for more than 1 pack per day was 2.71(1.17-6.29)(Table 25).

Table 25 Logistic Regression of SGA with Job Category Adjusted For Mother's Race, Mother's Age, And Cigarette Use.

Variable	Coefficient	SE	Coef/SE	OR	95%CI*
Constant	-1.0872	0.9743	8.4374		
Job Category**					
Administration	-0.1830	0.2890	0.4011	0.83	0.47-1.47
Electronics Repair	0.0654	0.3889	0.0283	1.06	0.50-2.29
Logistics	0.0522	0.2743	0.363	1.05	0.62-1.80
Maintenance	0.3751	0.2313	2.6310	1.46	0.92-2.29
Medical	0.1104	0.2591	0.1817	1.12	0.67-1.86
Supply&Services	-0.6330	0.3241	3.8161	0.53	0.28-1.00
Mother's Race***					
Asian	0.5577	0.2551	4.7788	**1.75**	**1.06-2.88**
Black	0.8436	0.1512	31.1184	**2.32**	**1.72-3.13**
Hispanic	0.2783	0.2113	1.7351	1.32	0.87-2.00
Mother's Age	-0.0278	0.0142	3.8588	0.98	0.95-1.00
Cigarettes****					
< 1/2 pack/day	0.2248	0.2071	1.1782	1.25	0.83-1.88
1/2 - 1 pack/day	0.7772	0.2064	14.1763	**2.17**	**1.45-3.26**
> 1 pack/day	0.9959	0.4032	6.1014	**2.71**	**1.17-6.29**

* Woolf's method
** Non-soldiers as reference category
*** Caucasians as reference category
**** Non-smokers as reference category

After adjusting for mother's race, cigarette use, and marital status, none of the odds ratios for any of the job categories and preterm birth were statistically significant or greater than 1.5 (Table 26). None of the following variables substantially altered the job category regression coefficient or were statistically significant: mother's age, income, caffeine consumption, or education level.

There was a significant relationship between mother's race and preterm birth. Infants who were preterm were more likely to be offspring of Black women regardless of job category or soldier status. The odds ratio for preterm birth and Black race was 1.49(1.06-2.09)(Table 26).

Cigarette use was significantly related to preterm birth, only in the less than 1/2 pack per day category. The odds ratios for less than 1/2 pack per day was 1.59(1.05-2.39)(Table 26). Marital status was not significantly related to preterm birth in the presence of job category.

Table 26 Logistic Regression of Preterm Birth with Job Category Adjusted For Mother's Race, Cigarette Use, And Marital Status.

Variable	Coefficient	SE	Coef/SE	OR	95%CI*
Constant	-2.7866	0.2879	93.6589		
Job Category**					
Administration	0.3072	0.2727	1.2691	1.36	0.80-2.32
Electronics Repair	-0.8301	0.6048	1.8839	0.44	0.13-1.43
Logistics	-0.3687	0.3576	1.0632	0.69	0.34-1.40
Maintenance	-0.1661	0.3115	0.2843	0.85	0.50-1.56
Medical	-0.1052	0.3087	0.1160	0.90	0.49-1.65
Supply&Services	-0.2995	0.3192	0.8800	0.74	0.40-1.39
Mother's Race***					
Asian	-0.2948	0.3547	0.6910	0.74	0.37-1.49
Black	0.4021	0.1724	5.4389	**1.49**	**1.06-2.09**
Hispanic	0.0322	0.2319	0.0193	1.03	0.66-1.63
Cigarettes					
< 1/2 pack/day	0.4609	0.2090	4.8642	**1.59**	**1.05-2.39**
1/2 - < 1 pack/day	-0.2384	0.3097	0.5922	0.79	0.42-1.45
> 1 pack/day	0.3921	0.5344	0.5383	1.48	0.52-4.22
Marital Status*****					
Cohabiting	-0.7972	0.7332	1.1823	0.45	0.11-1.90
Divorced/Separated	-0.1475	0.4827	0.0934	0.86	0.33-2.22
Single/Never Married	0.5411	0.2096	6.6668	1.72	1.14-2.59

* Woolf's method
** Non-soldiers as reference category
*** Caucasians as reference category
**** Non-smokers as reference category
***** Married as reference category

Table 27 Relative Risk For Spontaneous Abortion Verses Previous Spontaneous Abortion, SGA verses Previous Low Birth Weight Infant, And Preterm Birth Verses Previous Preterm Birth.

Variable	OR	95%CI*
Spontaneous Abortion vs. Previous SAB	**1.64**	**1.29-2.09**
SGA vs. Previous LBW	**2.80**	**1.85-4.23**
Preterm Birth vs. Previous Preterm	**2.60**	**1.80-3.77**

* Taylor Series

Conclusions

Soldiers who reside in the barracks are at a disproportionately elevated rate of unplanned pregnancy, 77.9 percent of the pregnancies in this group were unplanned (Table 14). In addition, these same individuals are 4.3 times more likely than non-soldiers to have an unplanned pregnancy and 2.6 times more likely to have never utilized oral contraception (Table 15). In pregnant, barracks residents, 42.6 percent have been on active duty for one year or less (Table 16). These numbers are staggering. They represent a substantial adverse impact upon readiness and training, as well as, a financial cost in both lost man-hours and medical care. These soldiers represent the lowest ranking, least financially secure, and youngest sector of the Army. In general, they are the least able to provide for themselves and their children.

In the opinion of the senior investigator, based upon interviews with the subjects and twenty years of experience delivering health care to soldiers, this problem represents difficulties with access to health care. When a soldier

desires oral contraception, she must access the health care system by reporting on sick call. The soldier must first receive permission from her supervisor, then obtain a sick slip from her orderly room, then report to the troop medical clinic and be evaluated by a medical screener, and then is finally able to discuss her contraceptive needs with a credentialed health care provider.

During any one of these steps and potentially all of these steps, the soldier may be asked the reason for her request to attend sick call. Even though she may technically have the right to decline to answer, any answer perceived as vague, may cast doubts on the legitimacy of the soldier's need to attend sick call. It is a common occurrence for the supervisor, orderly room clerk, and medical screener to be in the same unit and actually live in the same barracks as the soldier wishing to attend sick call. Each step in this process is an access barrier to sick call.

This problem could be substantially reduced by allowing the soldier to simply telephone the troop medical clinic and

make an appointment for contraceptive counseling. An appointment slip could be mailed to the soldier or the soldier could report to the troop medical clinic and obtain the appointment slip for an evaluation. This could potentially reduce the need for the individual to share her personal information with so many members of her unit and increase her access to contraceptive health care. The examination could and should still take place in the soldier's troop medical clinic.

Soldiers serving in the logistics job category demonstrated an increased risk of spontaneous abortion, the odds ratio was 1.87(1.20-2.93), within the logistics job category soldiers in MOS 92A demonstrated an odds ratio of 2.55(1.48-4.37)(Tables 23,24). These were the only occupations found to be at risk for spontaneous abortion. This group should be further investigated to ascertain the mechanism of the increased risk.

Soldiers in general were not, and no soldier job categories were identified at increased risk of SGA in this current investigation (Table 25). The most important

predictors of SGA were mother's race, cigarette use, and previous history of SGA (Table 25,27). The increased risk of SGA and the following variables is demonstrated in the following odds ratios: Asian 1.75(1.06-2.88), Black 2.32(1.72-3.13), cigarette use 1/2 to 1 pack per day 2.17(1.45-3.26), and cigarette use more than 1 pack per day 2.71(1.17-6.29). The risk ratio for SGA and pervious LBW was 2.80(1.85-4.83).

Soldiers in general were not, and no soldier job categories were identified at increased risk of preterm birth in this current investigation (Table 25). The most important predictors of preterm birth were mother's race, cigarette use, and previous history of preterm birth (Table 25,27). The increased risk of preterm birth and the following variables is demonstrated in the following odds ratios: Black 2.32(1.72-3.13) and cigarette use less than 1/2 per day 1.59(1.05-2.39). The risk ratio for preterm birth and pervious preterm birth was 2.60(1.80-3.77).

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Appendix 1 Complete List of Varaible Obtained

Mother

Age in years
Average annual combined family income
Birth order of this pregnancy
Chronic disease history
Cigarette smoking
Daily caffeine intake
Educational level by highest degree completed
Eligibility Status
Gravidity
Intrauterine device(IUD) history
Marital status
Length of service in years
MOS
Number of days per week of exercise
Number of days temporary duty status (TDY) in the last 6 months
Number of days TDY in the last 1 year
Number of days the field in the last 6 months and last 1 year
Number of hours per week in a motor pool
Number of hours sitting and standing per day while working
Number of hours actually working in assigned MOS per day
Number of miles per week running/jogging
Number of persons living in the immediate household
Occupation
Oral contraceptive use
Parity
Planned pregnancy
Previous birth defects
Previous ectopic pregnancies
Previous elective abortions
Previous intrauterine fetal demise
Previous low birth weight infants
Previous multiple birth deliveries
Previous pelvic inflammatory disease(PID)
Previous pregnancy complications
Previous preterm deliveries

Previous spontaneous abortions
Race
Rank

Father
Age
Educational level
MOS
Number of days away due to occupation in the last 6 months and 1 year
Occupation
Race
Rank

Outcome Variables
APGARS 1min and 5min
Birth weight grams
Gestational age in weeks
Head circumference centimeters
Length centimeters
Small for gestational age (< 10th percentile for GA)
Preterm delivery (<37 wks GA)
Spontaneous abortion (fetal loss prior to 20 wks GA)

Appendix 2

Occupational categories by Career Management Field

Administration & Data Processing
- 46 series Public Affairs
- 71 series Administration
- 74 series Automatic Data Processing
- 79 series Recruitment and Reenlistment
- 81 series Topographic Engineering

Electronics Repair
- 16 series Air Defense Artillery
- 23 series Air Defense System Maintenance
- 27 series Land and Combat Air Defense Systems

Maintenance
- 28 series Aviation Communications-Electronic Systems
- 29 series Signal Maintenance
- 31 series Signal Operations
- 33 series Electronic Warfare/Intercept Systems

Maintenance
- 51 series General Engineering
- 93 series Aviation Operations
- 96 series Military Intelligence
- 98 series Electronic Warfare/Cryptologic Operations

Maintenance (Motor Vehicle & Aircraft)
- 63 series Mechanical Maintenance
- 67 series Aircraft Maintenance
- 88 series Transportation

Medical
- 91 series Medical
- 92 series Medical Laboratory

Supply and Services
- 25 series Visual Information(photographer)
- 54 series Chemical
- 55 series Ammunition
- 76 series Supply and Services
- 77 series Petroleum and Water

94 series Food Service
95 series Military Police
97 series Bands